How We'll Get Back to the Moon

Before the end of the next decade, NASA astronauts will again explore the surface of the moon. And this time, we're going to stay, building outposts and paving the way for eventual journeys to Mars and beyond. There are echoes of the iconic images of the past, but it won't be your grandfather's moon shot.

This journey begins soon, with the development of a new spaceship. Building on the best of Apollo and shuttle technology, NASA's creating a 21st century exploration system that will be affordable, reliable, versatile, and safe.

NASA's new Crew Exploration Vehicle (CEV), with solar panels deployed, docked with a lander in lunar orbit. (Artist's concept by John Frassanito and Associates.)

The centerpiece of this system is a new spacecraft designed to deliver crew and supplies to the International Space Station, carry four astronauts to and from the moon, and support up to six crewmembers on future missions to Mars.

The new crew vehicle will be shaped like an Apollo capsule, but it will be three times larger, allowing four astronauts to travel to the moon at a time.

The new spacecraft has solar panels to provide power, and both the capsule and the lunar lander use liquid methane in their engines. Why methane? NASA's thinking ahead, planning for a day when future astronauts can convert Martian resources into methane fuel.

The new ship can be reused up to 10 times. After the craft parachutes to dry land (with a splashdown as a backup option), NASA can easily recover it, replace the heat shield, and launch it again.

Coupled with the new lunar lander, the system sends twice as many astronauts to the surface as Apollo, and they can stay twice as long. And while Apollo was limited to landings along the moon's equator, the new ship carries enough propellant to land anywhere on the moon's surface.

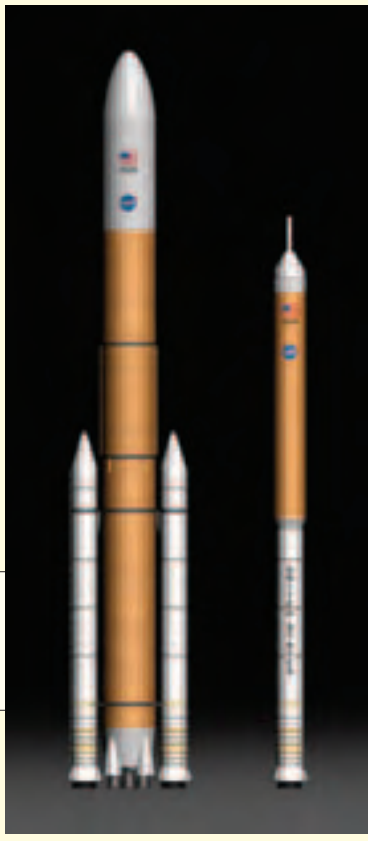
Once a lunar outpost is established, the crew could remain on the lunar surface indefinitely. The spacecraft can also operate without a crew in lunar orbit, eliminating the need for one astronaut to stay behind while others explore the surface.

Safe and reliable

The launch system that will get the crew off the ground builds on powerful, reliable shuttle propulsion elements. Astronauts will launch on a rocket made up of a single shuttle solid rocket booster, with a second stage powered by a shuttle main engine.

A second, heavy-lift system uses a pair of longer solid rocket boosters and five shuttle main engines to put up to 125 metric tons in orbit—about one and a half times the weight of a shuttle orbiter. This versatile system will be used to carry cargo and to put the components needed to go to the moon and Mars into orbit. The heavy-lift rocket can be modified to carry crew as well.

Best of all, these launch systems are 10 times safer than the shuttle because of an escape rocket on top of the capsule that can quickly blast the crew away if launch problems develop. There's also little chance of damage from debris, since the capsule sits on top of the rocket.

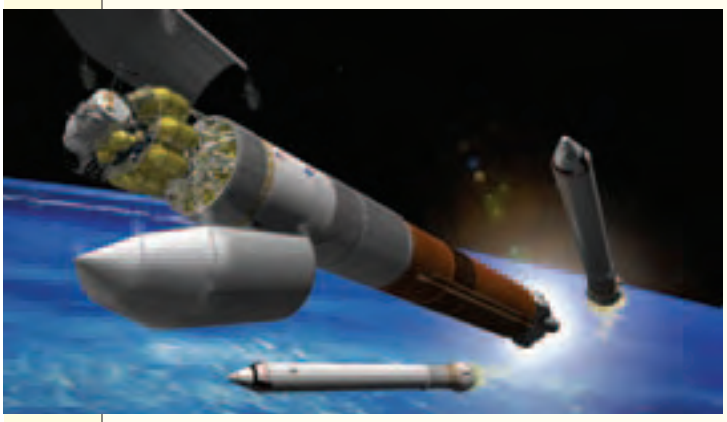


An engineering concept shows new heavy-lift and crew launch vehicles. (Credit: NASA)

The Flight Plan

In just 5 years, the new ship will be ready to ferry crew and supplies to the international space station. Plans call for as many as six trips to the outpost a year. In the meantime, robotic missions will lay the groundwork for lunar exploration. In 2018, humans will return to the moon. Here's how a mission would unfold:

A heavy-lift rocket blasts off, carrying a lunar lander and a "departure stage" needed to leave Earth's orbit (top). The crew launches separately (middle), then docks their capsule with the lander and departure stage and heads for the moon (bottom).



Three days later, the crew jettisons the departure stage and goes into lunar orbit (top). The four astronauts climb into the lander, leaving the capsule to wait for them in orbit. After landing and exploring the surface for seven days, the crew blasts off in the top half of the lander (bottom left), docks with the capsule and travels back to Earth, where the capsule deploys parachutes and sets down on dry land (bottom right).

"Into the Cosmos"

With a minimum of two lunar missions per year, momentum will build quickly toward a permanent outpost. Crews will stay longer and learn to exploit the moon's resources, while landers make one-way trips to deliver cargo. Eventually, the new system could rotate crews to and from a lunar outpost every 6 months.

Planners are already looking at the lunar south pole as a candidate for an outpost because of high hydrogen content, the possible presence of water ice, and an abundance of sunlight to provide power.

These plans give NASA a huge head start in getting to Mars. We will already have the heavy-lift system needed to get there, as well as a versatile crew capsule and propulsion systems that can make use of Martian resources. A lunar outpost just 3 days away from Earth will give us needed practice of "living off the land" away from our home planet, before making the longer trek to Mars.

NASA is embarking on this robust exploration program to advance our Nation's scientific, security, and economic interests. In conducting missions to the moon, Mars and beyond, NASA will help fuel American creativity, innovation, and technology development. Indeed, throughout NASA's history, technologies developed to advance our exploration missions have been productively utilized to boost economic progress and benefit millions of people here on Earth. On a broader level, civilization's expansion into space is a continuation of the ancient human imperative to explore, discover and understand, and to settle new territory when it becomes possible to do so.

As President Bush said when he announced the Vision for Space Exploration, "Humans are headed into the cosmos." Now we know how we'll get there.

For more information, visit *http://www.nasa.gov/exploration*.